United Monolithic Semiconductors

CHA6005-99F

8-12GHz High Power Amplifier

GaAs Monolithic Microwave IC

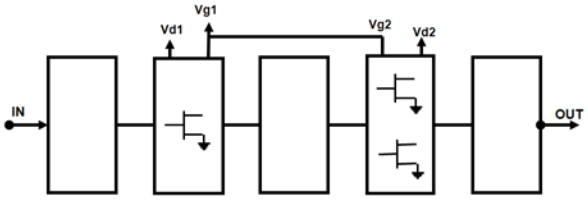
Description

The CHA6005-99F is a High Power Amplifier monolithic circuit, which integrates two stages and produces 32.5dBm output power associated to a high power added efficiency of 38%.

It is designed for a wide range of applications, from defense to commercial communication systems.

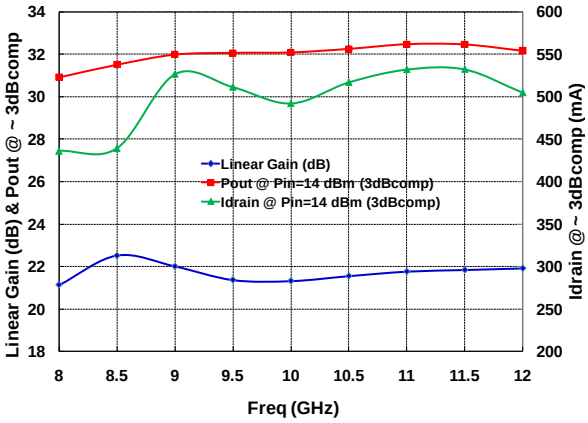
The circuit is manufactured with a pHEMT process, 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- High power : 32.5dBm
- High PAE : 38%
- Frequency band : 8-12GHz
- Linear gain : 22dB
- DC bias: Vd=8Volt@Id=350mA
- Chip size 3.0x1.5x0.1mm



Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	8		12	GHz
G	Linear Gain	20	22		dB
P3dB	Output Power @ 3dB comp.	30	32.5		dBm
PAE	Power Added Efficiency @ 3dB comp.		38		%

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Electrical Characteristics

Tamb.= +25°C, Vd = +8V; Drain Pulse width = 25µs, Duty cycle = 10%

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Operating frequency	8		12	GHz
G	Small signal gain	20	22		dB
dBS11	Input Return Loss		13		dB
dBS22	Output Return Loss		10		dB
P1dB	Output power @ 1dBcomp	29	31.5		dBm
P3dB	Output power @ 3dBcomp	29.5	32		dBm
PAE	Power Added Efficiency @ 3dBcomp		38		%
Id_3dBc	Supply drain current @ 3dBcomp		500	600	mA
Vd1, 2	Drain supply voltage		8		V
Idq	Supply quiescent current		350		mA
Vg	Gate supply voltage		-1		V

These values are representative of on-wafer measurements that are made without bonding wires at the RF ports.
A bonding wire of typically 0.25 to 0.3nH will improve the matching at the accesses.

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Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	9.5	V
Idq	Quiescent drain bias current	450	mA
Id	Drain bias current	800	mA
Pin	Maximum peak input power overdrive (2)	+20	dBm
Tj	Junction temperature	175	°C
Ta	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.
(2) Duration < 1s.

Typical Bias Conditions

Tamb.= +25°C

Symbol	Pad Nº	Parameter	Values	Unit
V1	V1	Drain supply voltage	8	V
V2	V2	Gate supply voltage	-1	V

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Typical on-wafer Sij parameters

Tamb.= +25°C, Vd = +8V, Id = 350mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
1.0	-0.13	-24.56	-41.65	94.28	-41.00	5.33	-0.14	-31.59
1.5	-0.41	-36.99	-73.73	-169.07	-33.87	124.41	-0.25	-46.43
2.0	-0.91	-49.02	-69.95	74.68	-23.74	83.31	-0.36	-60.62
2.5	-1.58	-59.45	-63.20	3.88	-18.60	78.66	-0.45	-76.49
3.0	-2.38	-68.02	-56.66	157.15	-10.90	48.69	-0.33	-92.84
3.5	-2.84	-74.73	-63.04	94.69	-6.27	4.33	-0.30	-108.37
4.0	-3.31	-82.38	-57.85	-114.80	-3.73	-33.50	-0.46	-125.86
4.5	-3.93	-90.68	-60.34	158.64	-1.35	-66.01	-0.48	-144.00
5.0	-4.31	-97.82	-60.03	24.56	1.15	-94.43	-1.12	-163.74
5.5	-4.83	-106.35	-50.57	-80.01	4.11	-123.24	-1.84	175.57
6.0	-5.46	-116.08	-70.50	131.94	7.63	-154.66	-2.81	149.75
6.5	-6.62	-124.18	-55.54	-157.24	11.36	170.68	-4.14	117.44
7.0	-8.19	-132.30	-53.46	-7.29	15.47	129.40	-6.12	71.13
7.5	-9.90	-137.14	-55.00	-29.83	19.90	79.16	-7.72	6.74
8.0	-11.75	-139.76	-57.16	-149.65	22.91	14.32	-8.43	-68.64
8.5	-14.25	-147.90	-51.44	49.02	23.09	-50.26	-10.58	-110.20
9.0	-22.50	-149.89	-61.08	68.48	22.44	-104.62	-12.35	-122.40
9.5	-19.68	-36.57	-61.46	37.28	22.18	-154.83	-11.34	-131.10
10.0	-11.97	-46.88	-49.78	-37.51	22.25	154.10	-10.95	-144.80
10.5	-9.48	-66.85	-54.09	43.84	22.31	99.85	-11.30	-158.95
11.0	-9.03	-76.06	-45.08	-123.49	22.21	43.81	-12.08	-174.53
11.5	-8.28	-75.50	-45.12	-167.53	22.20	-18.84	-14.05	168.12
12.0	-7.24	-77.36	-46.53	178.36	21.59	-93.01	-19.54	110.78
12.5	-6.28	-73.12	-50.56	143.28	17.68	-177.82	-16.12	-41.18
13.0	-4.14	-77.38	-45.11	-73.10	10.97	108.88	-11.80	-75.70
13.5	-2.77	-86.29	-40.75	-41.28	3.20	49.97	-10.40	-90.23
14.0	-2.03	-97.24	-43.07	39.37	-4.83	-0.77	-8.93	-101.41
14.5	-1.55	-108.80	-46.25	-168.74	-12.75	-42.90	-7.39	-116.10
15.0	-1.57	-118.06	-61.73	-65.61	-20.85	-80.03	-6.32	-123.79
15.5	-1.81	-127.31	-40.65	56.06	-28.30	-106.29	-5.11	-131.17
16.0	-1.92	-138.32	-51.69	-38.56	-36.54	-126.10	-4.24	-145.42
16.5	-2.40	-143.30	-37.13	17.09	-40.98	170.77	-5.04	-150.20
17.0	-1.78	-155.35	-53.00	-31.01	-52.02	96.09	-3.40	-156.88
17.5	-2.71	-171.55	-30.56	-18.51	-34.16	104.30	-2.95	-165.99
18.0	-4.54	169.63	-37.57	-134.74	-41.04	-142.48	-3.18	-173.70

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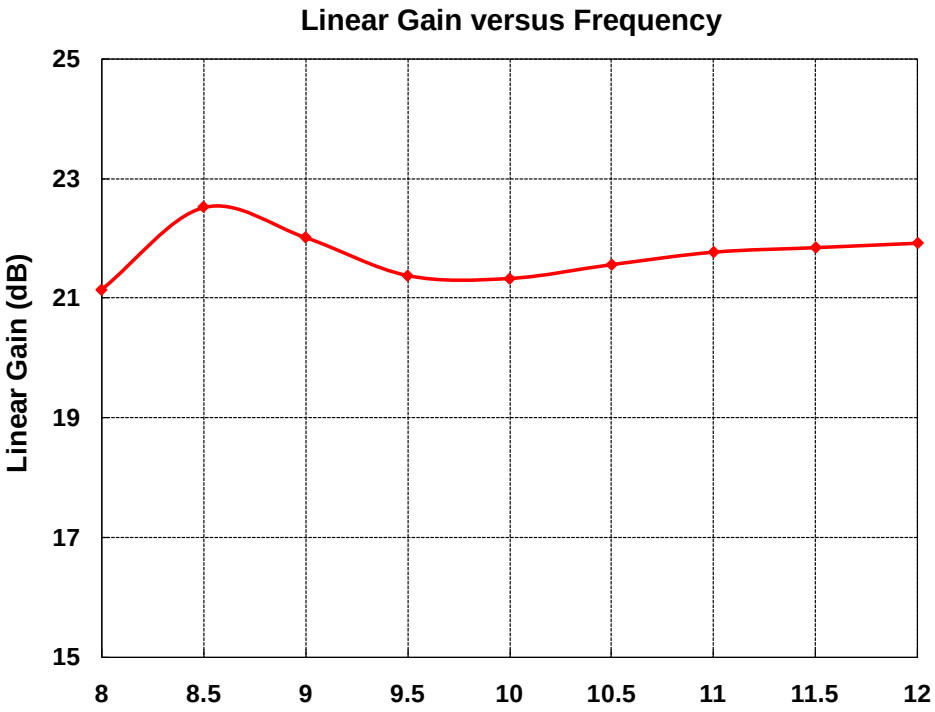
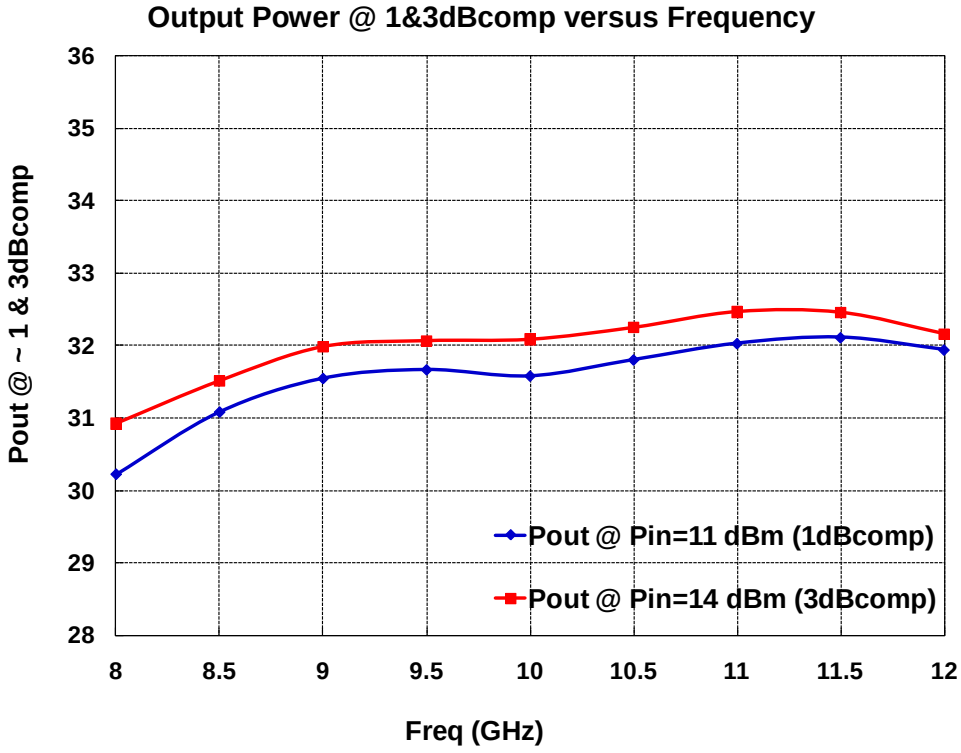
Typical on Test Fixture Measurements

Tamb.= +25°C,
Vd = 8V, Id (Quiescent) = 350mA, Drain Pulse width = 25µs, Duty cycle = 10%





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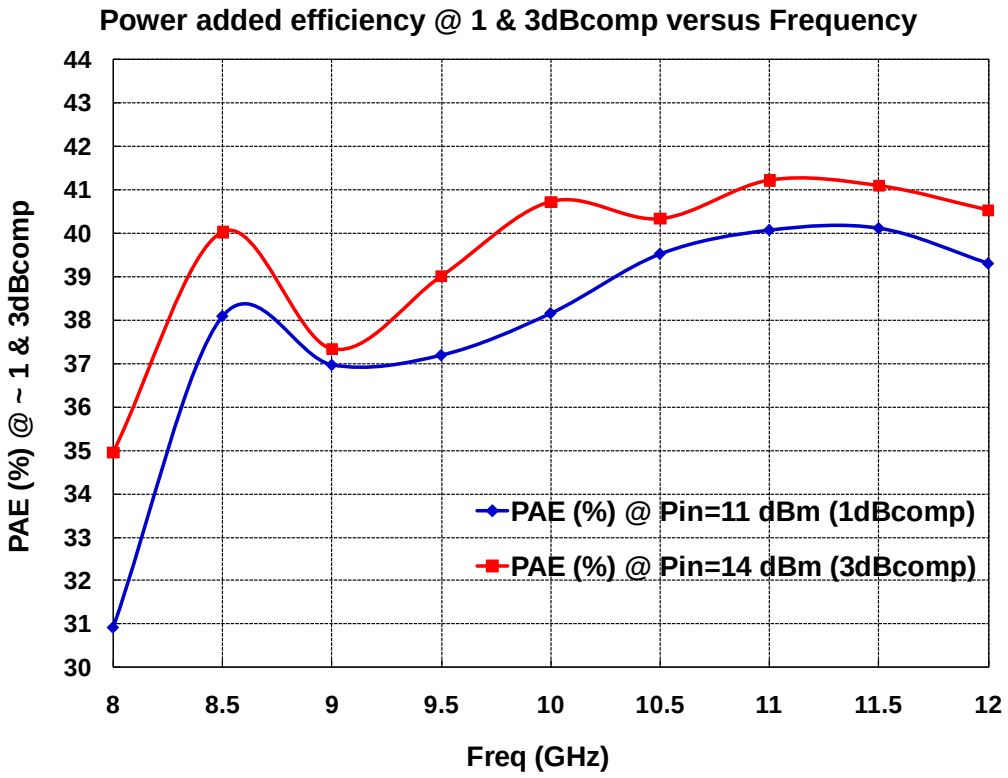

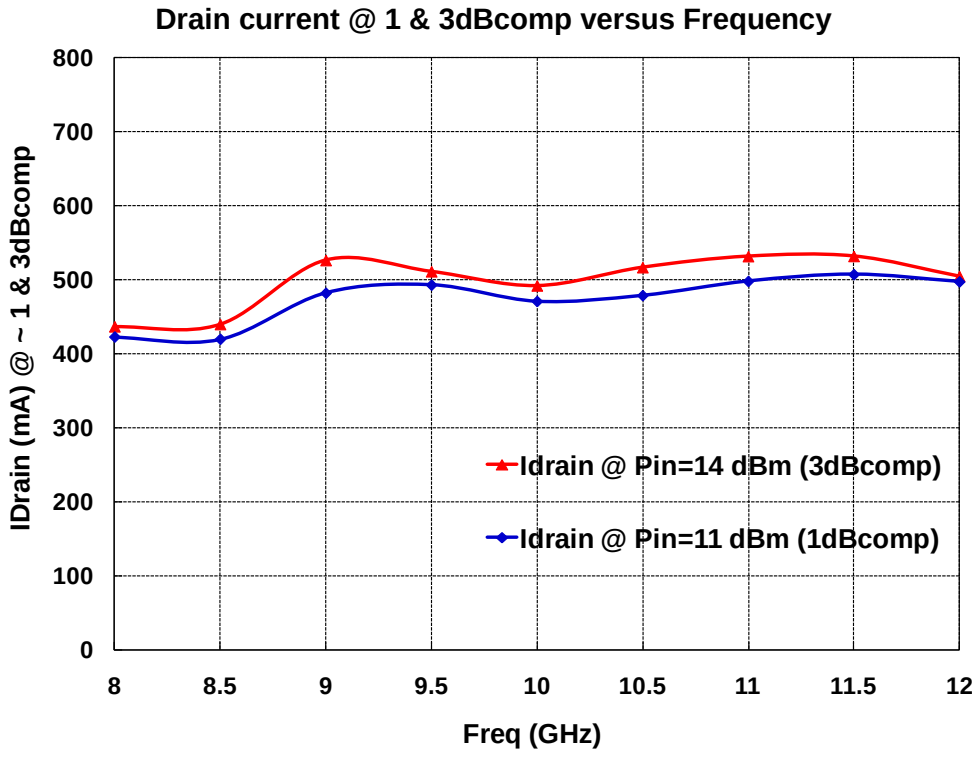

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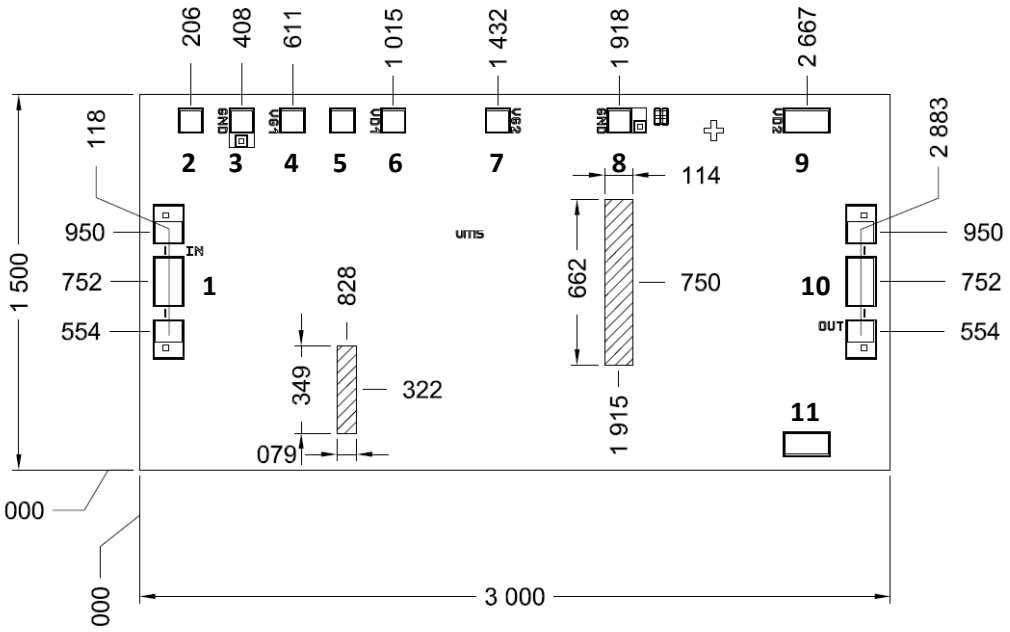
Mechanical data



Active device

UNITS : μm
Tol : $\pm 35\mu$m

Chip thickness: 70µm ±10µm
Chip size: 3000µm x 1500µm ±35µm
All dimensions are in micrometers

RF pads (1, 10) = 128 x 200µm²
DC pads (4, 6, 7, 8) = 100 x 100µm²
DC pad 9 = 200 x 100µm²

Pin number	Pin name	Description
1	IN	Input RF
2; 5; 11	-	Not Connected
4	VG1	Vg1
6	VD1	Vd1
7	VG2	Not Connected
3; 8	GND	Not Connected
9	VD2	Vd2
10	OUT	Output RF

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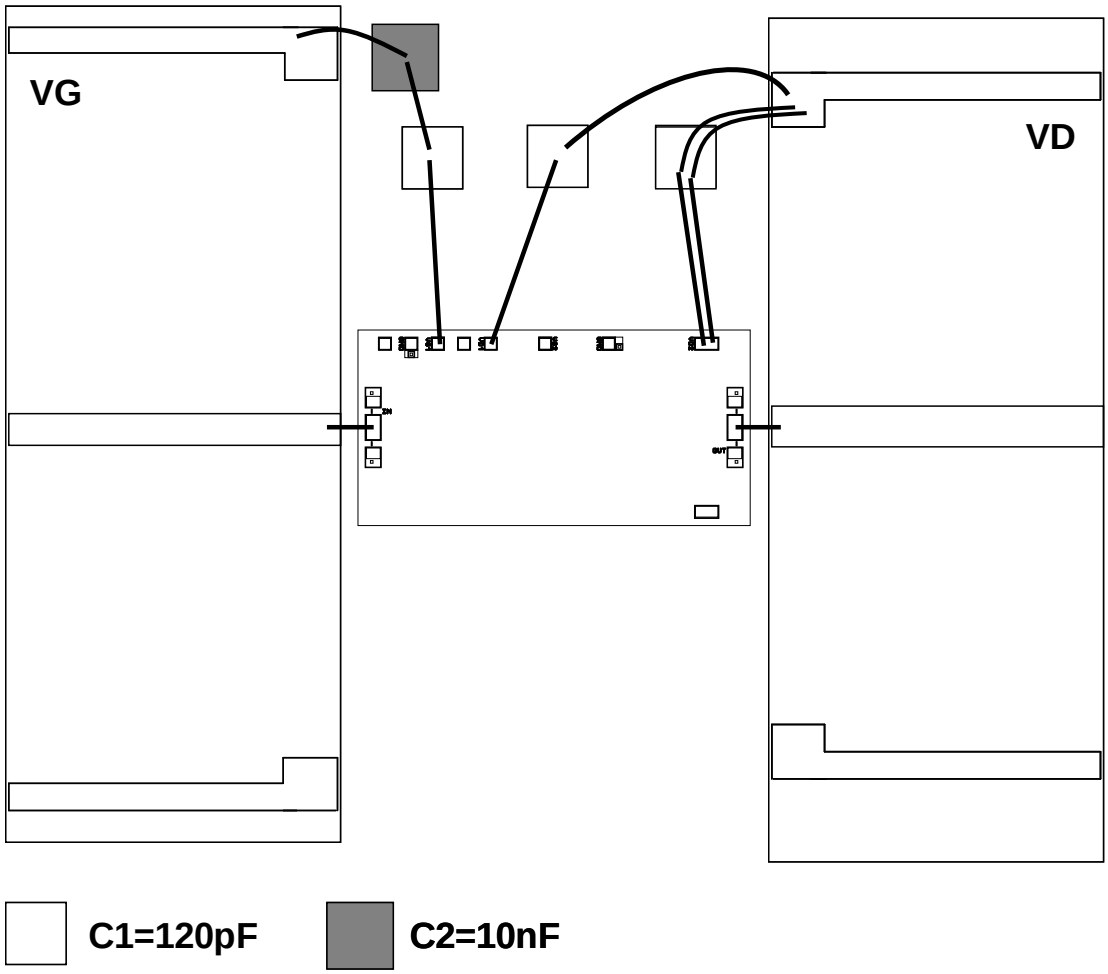
Recommended assembly plan



25µm wedge bonding is preferred

Note: Equivalent RF Wire Bonding: 0.25nH (typical length of 200µm for a 25µm diameter wire).

Recommended circuit bonding table

Port	Connection	External capacitor
IN	Inductance (Lbonding) = 0.3nH 400µm length with a wire diameter of 25 µm	
OUT	Inductance (Lbonding) = 0.3nH 400µm length with a wire diameter of 25 µm	
VG	Inductance ≤ 1nH	C1 ~ 120pF, C2 ~ 10nF
VD	Inductance ≤ 1nH	C1 ~ 120pF

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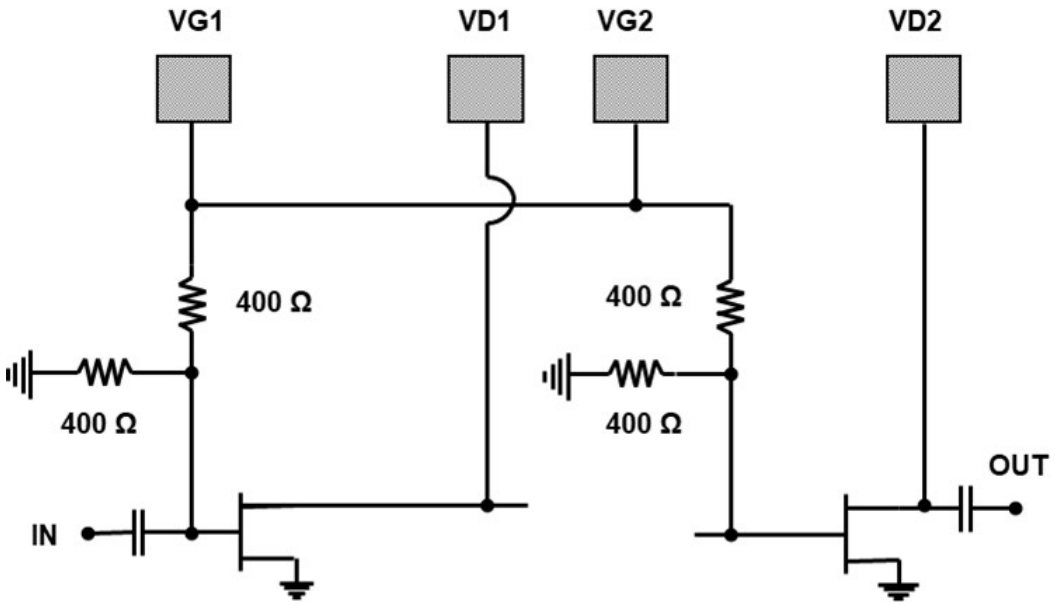
DC Schematic

Medium Power Amplifier: 8V, 350mA



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Recommended ESD management

Refer to the application note AN0020 available at https://www.ums-rf.com for ESD sensitivity and handling recommendations for the UMS products.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACh N°1907/2006. More environmental data are available in the application note AN0019 also available at https://www.ums-rf.com.

Ordering Information

Chip form:	CHA6005-99F/00

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